



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re the Application of:

MARK W. MILES, ET AL.

Application No.: 10/076,224

Filed: February 13, 2002

For: **Controlling Micro-Electro-Mechanical
Cavities**

Art Group: 2873

Examiner: Not yet assigned

INFORMATION DISCLOSURE STATEMENT UNDER 37 C.F.R. §1.97

Commissioner for Patents
Washington, D.C. 20231

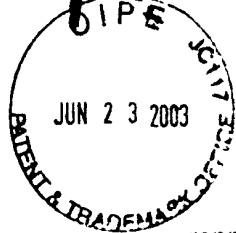
Sir:

In accordance with the duty of disclosure, enclosed is a copy of Information Disclosure Statement by Applicant (form PTO/SB/08), which is being submitted before the mailing of a first Office Action. It is respectfully requested that the cited references be considered and that the enclosed copy of PTO/SB/08 be initialed by the Examiner to indicate such consideration and a copy thereof returned to applicant(s).

06/24/2003 MBIZUNES 00000102 10076224

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Please charge any fees due to Deposit Account 02-2666. A duplicate copy of the Fee Transmittal (PTO/SB/17) is enclosed for this purpose.

Respectfully submitted,

BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP

Date: 6/20/2003

Vani Moodley, Under 37 CFR Section 10.9(b),

12400 Wilshire Blvd., 7th Floor
Los Angeles, California 90025
(408) 720-8300

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INFORMATION DISCLOSURE

STATEMENT BY APPLICANT

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Application Number	10/076,224
Filing Date	February 13, 2002
First Named Inventor:	Mark W. Miles
Group Art Unit	2873
Examiner Name	Not yet assigned
Attorney Docket Number	05652.P017X

U.S. PATENT DOCUMENTS

Exam. Initial*	Cite No. ¹	U.S. Patent Document		Name of Patentee or Applicant of Cited Document	Date of Publication of Cited Document MM-DD-YYYY	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		Number	Kind Code ² (If known)			
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		3,439,973		Paul et al.	4/22/69	
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		Office ³	Number ⁴	Kind Code ⁵ (If known)				
		WO 95	30,924		Etalon, Inc.	11/16/95		
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	✓	5,381,253		Sharp et al.	1/10/95	
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	✓	5,459,610		Bloom et al.	10/17/95	
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	✓	5,500,761		Goossen et al.	3/19/96	
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	✓	5,552,925		Worley	09/03/96	
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	✓	5,636,052		Arney et al.	6/3/97	
	✓	5,636,185		Brewer et al.	6/3/97	
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	✓	5,710,656		Goossen	1/20/98	
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	✓	5,793,504		Stoll	08/11/98	
	✓	5,808,780		McDonald	09/15/98	
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	✓	5,835,255		Miles	11/10/98	
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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(21) International Application Number: PCT/US95/05358 (22) International Filing Date: 1 May 1995 (01.05.95) (30) Priority Data: 08/238,750 5 May 1994 (05.05.94) US (60) Parent Application or Grant (63) Related by Continuation US 08/238,750 (CIP) Filed on 5 May 1994 (05.05.94) (71) Applicant (for all designated States except US): ETALON, INC. [US/US]; 33 Hanson Street, Boston, MA 02118 (US). (72) Inventor; and (75) Inventor/Applicant (for US only): MILES, Mark, W. [US/US]; 33 Hanson Street, Boston, MA 02118 (US). (74) Agent: FEIGENBAUM, David, L.; Fish & Richardson P.C., 225 Franklin Street, Boston, MA 02110-2804 (US).		(81) Designated States: CA, CN, JP, KR, MX, US, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published With international search report.
(54) Title: VISIBLE SPECTRUM MODULATOR ARRAYS <div> </div> (57) Abstract <p>Light in the visible spectrum is modulated using an array of modulation elements (501), and control circuitry connected to the array for controlling each of the elements having a surface (506) which is caused to exhibit a predetermined impedance characteristic to particular frequencies of light. The amplitude of light delivered by each of the modulation elements is controlled independently by pulse code modulation. Each modulation element has a deformable portion (508) held under tensile stress, and the control circuitry controls the deformation of the deformable portion. Each deformable element has a deformation mechanism and an optical portion independently imparting to the element respectively a controlled deformation characteristic and a controlled modulation characteristic. The deformable modulation element may be a non-metal. The elements are made by forming a sandwich of two layers and a sacrificial layer between them, the sacrificial layer having a thickness related to the final cavity dimension, and using chemical (e.g., water) or a plasma based etch process to remove the sacrificial layer.</p>		

VISIBLE SPECTRUM MODULATOR ARRAYS

Background

5 This is a continuation-in-part of United States
Patent Application Serial Number 08/238,750, filed May 5,
1994, which is a continuation-in-part of Serial No.
08/032,711, filed March 17, 1993.

 This invention relates to visible spectrum
10 (including ultra-violet and infrared) modulator arrays.

 Visible spectrum modulator arrays, such as backlit
LCD computer screens, have arrays of electro-optical
elements corresponding to pixels. Each element may be
electronically controlled to alter light which is aimed
15 to pass through the element. By controlling all of the
elements of the array, black and white or, using
appropriate elements, color images may be displayed.
Non-backlit LCD arrays have similar properties but work
on reflected light. These and other types of visible
20 spectrum modulator arrays have a wide variety of other
uses.

Summary of the Invention

 In general, in one aspect, the invention features
modulation of light in the visible spectrum using an
25 array of modulation elements, and control circuitry
connected to the array for controlling each of the
modulation elements independently, each of the modulation
elements having a surface which is caused to exhibit a
predetermined impedance characteristic to particular
30 frequencies of light.

 Implementations of the invention may include the
following features. The surface may include antennas
configured to interact with selected frequencies of
light, or the surface may be a surface of an interference

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cavity. The impedance characteristic may be reflection of particular frequencies of light, or transmission of particular frequencies of light. Each of the modulation elements may be an interference cavity that is deformable to alter the cavity dimension. The interference cavity may include a pair of cavity walls (e.g., mirrors) separated by a cavity dimension. One of the mirrors may be a broadband mirror and the other of the mirrors may be a narrow band mirror. Or both of the mirrors may be narrow band mirrors, or both of the mirrors may be broadband, non-metallic mirrors. The cavity may have a cavity dimension that renders the cavity resonant with respect to light of the frequency defined by the spectral characteristics of the mirrors and intrinsic cavity spacing in an undeformed state. One of the mirrors may be a hybrid filter. One (or both) of the walls may be a dielectric material, a metallic material, or a composite dielectric/metallic material. The cavity may be deformable by virtue of a wall that is under tensile stress. The control circuitry may be connected for analog control of the impedance to light of each element. The analog control may be control of the degree of deformity of the deformable wall of the cavity.

The predetermined impedance characteristic may include reflection of incident electromagnetic radiation in the visible spectrum, e.g., the proportion of incident electromagnetic radiation of a given frequency band that is, on average, reflected by each of the modulation elements. The modulation element may be responsive to a particular electrical condition to occupy either a state of higher reflectivity or a state of lower reflectivity, and the control circuitry may generate a stream of pulses having a duty cycle corresponding to the proportion of incident radiation that is reflected and places the modulation element in the higher state of reflectivity

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during each the pulse and in the lower state of reflectivity in the intervals between the pulses. The characteristic may include emission of electromagnetic radiation in the visible spectrum. The characteristic
5 may include the amount of electromagnetic radiation in the visible spectrum that is emitted, on average, by the antennas. The characteristic may be incident electromagnetic radiation in the visible spectrum. The modulation elements may include three sub-elements each
10 associated with one of three colors of the visible spectrum. The modulation element may be responsive to a particular electrical condition to occupy either a state of higher transmissivity or a state of lower transmissivity, and the control circuitry may generate a
15 stream of pulses having a duty cycle corresponding to the proportion of incident radiation that is transmitted and places the modulation element in the higher state of transmissivity during each the pulse and in the lower state of transmissivity in the intervals between the
20 pulses. The characteristic may include the proportion of incident electromagnetic radiation of a given frequency band that is, on average, transmitted by each of the modulation elements.

The visible spectrum may include ultraviolet
25 frequencies, or infrared frequencies.

In general, in another aspect of the invention, the control circuitry may be connected to the array for controlling the amplitude of light delivered by each of the modulation elements independently by pulse code
30 modulation.

In general, in another aspect, the invention features a modulation element having a deformable portion held under tensile stress, and control circuitry connected to control the deformation of the deformable
35 portion.

Implementations of the invention may include the following features. The modulation element may be self-supporting, or held on separate supports. The deformable portion may be a rectangular membrane supported along two
5 opposite edges by supports which are orthogonal to the membrane. The deformable portion, under one mode of control by the control circuitry, may be collapsed onto a wall of the cavity. The control circuitry controls the deformable portion by signals applied to the modulation
10 element, and the deformation of the control portion may be subject to hysteresis with respect to signals applied by the control circuitry.

In general, in another aspect, the invention features modulating light in the visible spectrum using a
15 deformable modulation element having a deformation mechanism and an optical portion, the deformation mechanism and the optical portion independently imparting to the element respectively a controlled deformation characteristic and a controlled modulation
20 characteristic.

Implementations of the invention may include the following features. The deformation mechanism may be a flexible membrane held in tensile stress, and the optical portion may be formed on the flexible membrane. The
25 optical portion may be a mirror. The mirror may have a narrow band, or a broad band, or include a hybrid filter.

In general, in another aspect, the invention broadly features a non-metal deformable modulation element.

30 In general, in another aspect, the invention features a process for making cavity-type modulation elements by forming a sandwich of two layers and a sacrificial layer between them, the sacrificial layer having a thickness related to the final cavity dimension,